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truth on thousands of students in their introductory courses of physics and physiology. When von Helmholtz elaborated the hypothesis it was of great value in coordinating the then known phenomena and in giving a basis for further research. But forty years have brought many changes, and if the hypothesis were now proposed anew by an unknown man it would not find a single adherent. No modern student of organic evolution can conceive how the three-fiber mechanism could develop from a unicellular organism already sensitive to light. No psychologist can conceive how three kinds of fibers make us see three primary colors as white light; they would more probably lead us to see white light as three colors, I should suppose. All the newer phenomena—the spectrum of faint light, color-blindness, contrast, after-images, the variations in the field of vision, etc.—not only do not support the hypothesis, but must be subjugated to it by unlikely subsidiary hypotheses. The phenomena of space perception are too complex to enter into here, but the ‘empiristic’ theory, of which von Helmholtz was properly proud in the sixties, seems now, after the writings of James, Ward, Stumpf and others, particularly naïve.

With some reluctance I must state that not only are the theories of the *Physiologische Optik* in large measure outgrown, but that in many cases the observations cannot be verified. In subjects in which I have myself worked—after-images, the discrimination of intensity, conflict of the fields of vision and others—new methods have given different and probably more correct results. This is the natural course of science. The work of a great investigator, if vital, must be the ladder by which we climb, but which we afterwards discard. The *Physiologische Optik* is still a great storehouse of facts and observations of contemporary importance, but we should regard it as closed thirty years ago.

The bibliography compiled by Professor König is an extremely useful piece of work, but I see no adequate reason for appending it to the *Physiologische Optik*. It may be delusive in leading the thoughtless to suppose that von Helmholtz had considered all these works; it makes the book needlessly bulky and expensive; it is compiled chiefly at second hand, with

many omissions and numberless minor errors.* Such an index should be published separately, and, if possible, revised and brought up to date every few years.

The criticisms that I have ventured to make apply only to the revision of the *Physiologische Optik*. If the first edition had been reprinted without alteration there would be nothing to express but admiration for a work of genius almost unrivalled in the history of science, and for a man of genius whose intellect was so profound and so far-reaching that of his contemporaries only Darwin stands beside him.

J. McKEEN CATTELL.

COLUMBIA UNIVERSITY.

Elementary Botany. By GEO. F. ATKINSON. New York, Henry Holt & Co. 1898. 12mo. Pp. xxiii+444.

This latest and best of elementary text-books of botany is a thoroughly commendable work, and reflects high credit upon the author and upon the publishers. In pleasing contrast to the larger number of books with similar titles and kindred scope it is fresh, accurate, comprehensive and readable. It must have a heavy sale as soon as teachers of botany become acquainted with its merits, for in no other American elementary botany now before the public is the subject-matter so thoroughly covered and the illustration so illuminating and suggestive.

The text has been classified by its author under three captions, physiology, morphology and ecology, in the order given, a modification of the ordinary arrangement. In the first

* Thus, in regard to American writers eighteen references are given to Professor Le Conte, but his book on ‘Sight’ is not included. A comparatively unimportant article by an American author is quoted three times, probably by accident. We find ‘Bowditch’ four lines after the name has been correctly given. My own name is given twice within five lines spelled incorrectly in two different ways. Mrs. Franklin’s name occurs four times, each time differently. Professor Le Conte Stevens’ name occurs five times in four different ways, never quite correctly. One of Professor Stevens’ articles is said to be in the ‘Amer. Journ. of Sc. Vol. XXIII,’ and the continuation of the article in the next number of the same journal is said to be in ‘Sill. Journ. XXIII.’ Indeed, I have noted sixteen different ways in which *The American Journal of Science* is referred to.

part protoplasm at work is the theme, and the various phenomena of cell-mechanics and cell-physiology are succinctly and skilfully described. Here are to be found the discussions of osmose, turgescence, root-pressure, transpiration, movement of liquids, diffusion, respiration, photosynthesis, growth and irritability, for all of which the splendid presentative abilities of the author are elicited. From the almost unlimited store of information to be had upon these subjects, Professor Atkinson has wisely selected, carefully condensed and tactfully eliminated so that his finished chapters bear the testimony to his unusual powers of criticism and compilation. Here and there original material is included, but always with modesty, and not at all in the far too common spirit which deems all personal results of value above any of the results of others.

In the chapters on morphology the same fine selective instinct is displayed and the completed lessons, extending over a representative series from the pond-scums to the Hawkweeds, are quite the best of their sort that have come under the observation of the reviewer. They are more than a bare enumeration of laboratory processes, more than a story about the plants and their life histories. They are a breathing, vital presentation of the principal matters of interest, structural, developmental and adaptational, which the young student should know and should remember. In the chapter on ferns the author has embodied many results of his own well-known and beautiful researches and, as elsewhere, has contrived always to use illustrations that illustrate, Figs. 231 and 232 being the only ones that can be described as inartistic, while all are scientifically adequate. The selection of types for study among flowering plants is particularly happy, and such varieties as can be obtained generally over at least the northern United States are emphasized.

The chapters on ecology are peculiarly interesting to the reviewer, since the field is one that he has attempted to cultivate, and in them many of his own results are included. Perhaps even under these circumstances he will be pardoned for speaking with something akin to enthusiasm, for certainly not even in Kerner or Warming has such a charming presentation

of the subject been accomplished. The matter is classified under the following chapter headings: winter buds, growth of woody shoots, leaf arrangement, seedlings, further studies in nutrition, dimorphism of ferns, formation of early spring flowers, heterospory, pollination, seed distribution, struggle for occupation of land, soil formation in rocky regions and in moors, zonal distribution of plants, plant communities, seasonal changes, adaptation of plants to climate. All of the chapters are finely illustrated with original figures in similitude, including a number that are destined to become classic, as, for example, Fig. 440 of the fairy ring fungus, Fig. 484 of an atoll moor and Fig. 503 of the walking-fern. Such a series of chapters ought to renew the youth of the driest botanical pedagogue that ever droned through his Gray's Manual by the aid of an 'artificial key,' and it ought to do more for botanical instruction in the schools of America than has been done by any book since Bessey's Botany.

With so much of good to say about Professor Atkinson's 'Elementary Botany' it would be a pity to add more than the merest soupçon of unfavorable comment. A few things might have been done better. Generic names have, no doubt, as much right to their capital letters as have the honored names of the author and publishers: 'elementary botany by g. f. atkinson, published by henry holt and co.' looks absurd and so does the sentence 'comparison of selaginella and isoetes with the ferns'—at least to the eyes of the reviewer. It is a blunder to speak about the roots of *Corallorhiza*, for the coral-root orchid has no roots at all, the underground micorhiza-infested region being the rhizome. And one cannot help regretting that the author should so constantly use 'will' and 'shall' in an un-rhetorical manner, as in the beginning of paragraph 3. Paragraph 718 will scarcely do; it is neither science nor poetry. No doubt it was intended to be pictorial, but the effect is *reporter-esque*; it reminds one of the society column of the Sunday paper.

None of these trifling blemishes interferes with the general cleverness, scientific accuracy and immense utility of the new 'Elementary Botany.' The publishers are to be congratu-

lated upon having brought out in these latter days such a virile volume.

CONWAY MACMILLAN.

SCIENTIFIC JOURNALS.

American Chemical Journal, November: 'On the cause of the retention and release of gases occluded by the oxides of metals:' By T. W. Richards. The author has studied the conditions under which the gases are given off and suggests a theory to account for the observed facts. 'New experiments on the quantitative synthesis of water:' By E. H. Keiser. The author has weighed the hydrogen and oxygen used and the water formed, and obtained figures which gave an atomic weight of 15.88 for oxygen if hydrogen is taken as 1. 'On the metaphosphimic acids:' By H. N. Stokes. The homologous series of compounds of the general formula $(\text{PNCl}_2)_n$ when saponified yield acids; but the higher members do not yield acids of the same general structure as the lower ones, a fact for which the author suggests an explanation based on the Baeyer 'tension theory.' 'The ethers of toluquinone oxime and their bearing on the space isomerism of nitrogen:' By J. L. Bridge and W. C. Morgan. 'On the claims of davyum to recognition as a chemical element:' By J. W. Mallet. The evidence seems to be against the existence of this element.

J. E. G.

THE *American Naturalist* for November opens with a paper by Professor Henry S. Williams entitled 'Variation versus Heredity,' maintaining the views previously described by him in SCIENCE; Professor William Patten contributes an article on the theory of color vision described by him at the American Physiological Society in 1897 and the American Morphological Society in 1896; Professor W. J. Beal gives examples of peculiar dispersion of seeds and fruits, and Professor C. B. Davenport summarizes the advance of biology in 1896 from the *Année biologique*.

THE first number of the second volume of the *American Journal of Physiology*, issued on November 22d, contains the following articles:

'On the Excretion of Kynurenic Acid:' By Lafayette B. Mendel and Holmes C. Jackson, Ph.B.

'On the Modification of Rigor Mortis resulting from Previous Fatigue of the Muscle, in Cold-Blooded Animals:' By Caroline W. Latimer, M.D.

'On the Relation of the Blood to the Automaticity and Sequence of the Heart-Beat:' By W. H. Howell.

'On the Relation of the Inorganic Salts of Blood to the Automatic Activity of a Strip of Ventricular Muscle:' By Charles Wilson Greene.

MESSRS. ROBERT AIKMAN & Co., Manchester, announce the publication of a new periodical, '*Science Work*,' edited by Mr. Walter Jeffs. It will be issued monthly and is intended to do for science what the *Review of Reviews* is doing in a wider field. The annual subscription is only 2/6—60 cents.

AT the winter meeting of Section H, American Association for the Advancement of Science, held at Ithaca, December 28, 1897, a committee was appointed to found a journal designed to promote the interests of anthropology in America. The committee held several meetings, conferred with publishers, and reported to Section H at the Boston meeting of the Association. It has been decided to undertake the publication, provided a sufficient number of persons indicate their willingness to support the movement by subscribing for the first volume. The journal will be issued in quarterly numbers of about two hundred octavo pages, forming an annual volume of about eight hundred pages, the first number to appear in January, 1899. The subscription price will be \$4. It will embrace: (1) papers pertaining to all parts of the domain of anthropology, the technical papers to be limited in number and length; (2) scientific notes and news pertaining to anthropology, and (3) a current bibliography of anthropology. The new journal will succeed the *American Anthropologist*, of the Anthropological Society of Washington, and the name of this journal may be adopted or a new name selected—'*American Journal of Anthropology*' and '*Anthropology*.' The journal will be published by Messrs. G. P. Putnam's Sons and conducted by the following editorial board: Dr. Frank Baker, Dr. Franz Boas, Dr. Daniel G. Brinton, Dr. George M. Dawson, Dr. George A. Dorsey, Professor W. H. Holmes, Major J. W. Powell, Professor F. W. Putnam; F. W. Hodge, *Secretary* and *Managing Editor*.